
DTI installation

This chapter describes the procedures for installing and removing DTI/CPI equipment and Clock Controllers in a variety of systems. The descriptions include cable requirements.

The first part of the chapter provides detailed information on the DTI card. A section on the Echo Canceller follows the DTI information. The last part of the chapter focuses on Clock Controllers.

Equipment overview

The DTI connects a Network loop to an external DS-1 interface for both voice and data transmission over 24 digital channels.

The DTI interface requires a **QPC472** DTI or **QPC720** Primary Rate Interface (PRI) card. Because this document deals with DTI functions, both cards are referred to as the “DTI” card or “DTI” hardware whenever their function is identical.

Clock Controllers synchronize the system clock rate with the clock rates of digital switching and transmission equipment over a T1 circuit. Dual CPU systems have two Clock Controllers: CC0 (associated with CPU 0) and CC1 (associated with CPU 1).

The standard Meridian 1 Clock Controller is the **QPC471**, currently available in vintages C, D, E, F, G, and H. Option 81 must use vintage H.

Customers outside the United States can use the **QPC775**. Vintage A of the QPC775 can be used with non-networked systems (systems linked directly to a central office); vintage B is appropriate for networked systems (Meridian 1 to Meridian 1 configuration). Customers with option 81 systems must use QPC775 vintage C.

Note: A system cannot use both the QPC471 and the QPC775. A system can mix Clock Controller vintages A through G. Vintage H Clock Controllers can be used only with another vintage H Clock Controller.

DTI interfaces

The DTI card provides a connection to the DS-1 channel interface directly through an office repeater or through an Echo Cancellor.

In the U.S.A., FCC Part 68 regulations require Network Channel Terminating Equipment (for example, the NTQRY551 Channel Service Unit) installed at each connection point of a private system to a registered common carrier trunk.

Echo Cancellers are required only if satellite transmission is used. The DTI card provides both a T1 line interface and a control interface to link with a signal format compatible with EIA standard RS-232-C. Both the DTI and the Echo Cancellor act as Data Terminal Equipment (DTE). The Echo Cancellor's control protocol must conform with that of the Tellabs Model 251.

QPC472 DTI specifications

The QPC472 DTI only requires power and ground from the backplane. Power requirements are as follows:

- +5 volts at 3 amperes
- +12 volts at 50 milliamperes
- 12 volts at 50 milliamperes

The QPC472 DTI contains five LEDs and five external connectors. **Table 1** shows the QPC472 transmission equalization SW2 switch settings for DTI for all systems. **Table 2** lists the external connectors located on the QPC472 DTI faceplate. **Figure 1** illustrates the faceplate layout.

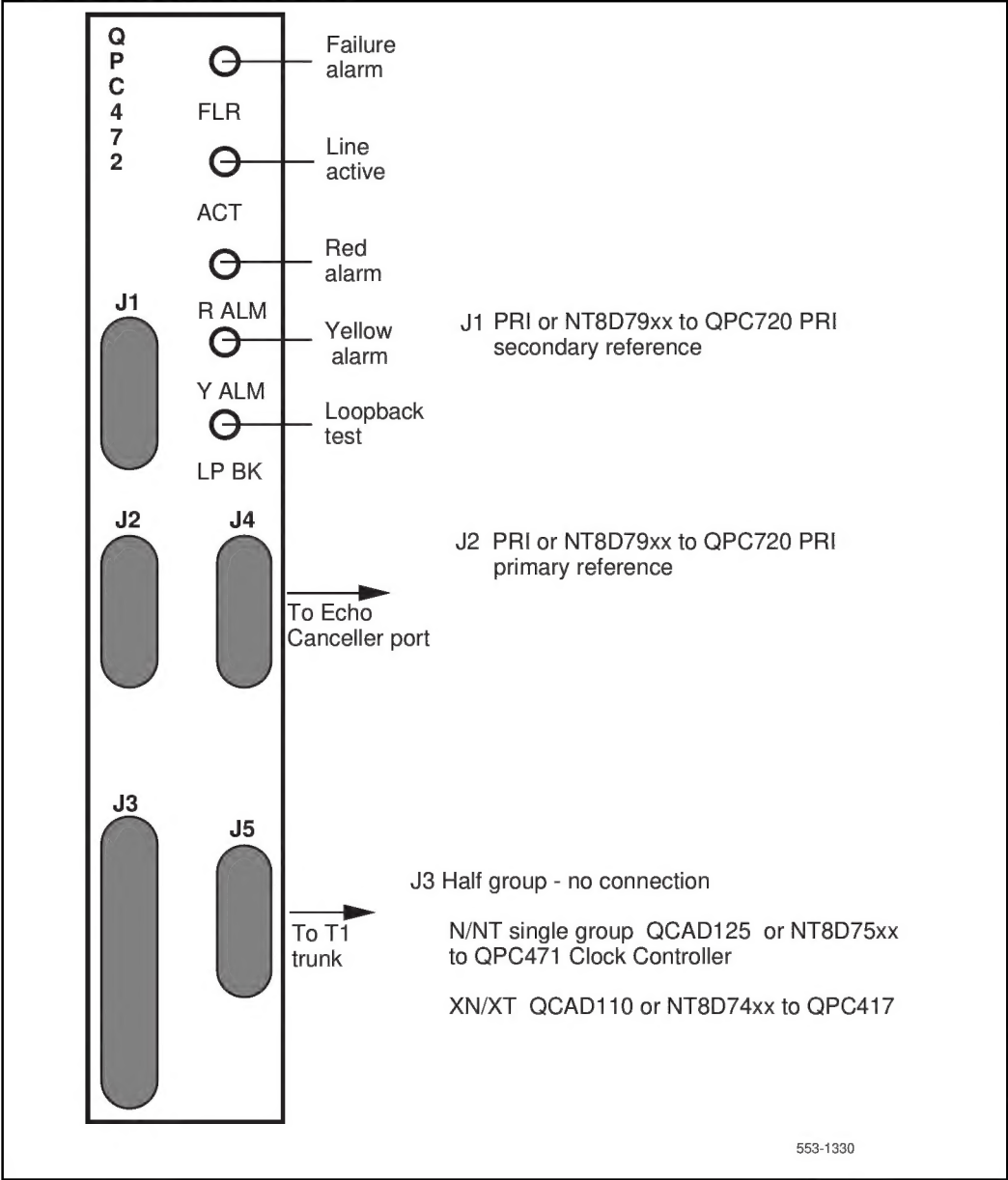
Table 1
QPC472 transmission equalization SW2 switch settings for DTI

Switch S2 settings	To repeatered facility	To cross-connect point
5 ON	0 - 45 m (0 - 150 ft.)	0 - 15 m (0 - 100 ft.)
2, 4, 6 ON	46 - 135 m (151 - 450 ft.)	16 - 100 m (101 - 355 ft.)
1, 3, 7 ON	136 - 225 m (451 - 750 ft.)	101 - 200 m (356 - 655 ft.)

Table 2
QPC472 DTI external connectors

Faceplate designations	Type
J1	9-pin female, D-connector
J2	9-pin female, D-connector
J3	36-pin connector
J4	15-pin female, D-connector
J5	15-pin male, D-connector

Figure 1
QPC472 DTI faceplate layout



QPC720 PRI specifications

The QPC720 PRI card can replace the QPC472 DTI. The two cards are compatible using X11 release 5 and later software.

The QPC720 PRI requires power and ground from the backplane only. Power requirements are as follows:

+5 volts at 6 amperes

+12 volts at 50 milliamperes

-12 volts at 50 milliamperes

The QPC720 PRI contains five LEDs and six external connectors. [Table 3](#) shows the transmission equalization SW2 switch settings and [Table 4](#) shows SW3 options. [Table 5](#) lists the external connectors located on the QPC720 PRI faceplate and [Figure 2](#) shows the faceplate layout.

Table 3

QPC720 transmission equalization SW2 switch settings for PRI/DTI

Switch S2 settings	To repeatered facility	To cross-connect point
5 ON	0 - 45 m (0 - 150 ft)	0 - 30 m (0 - 100 ft)
2, 4, 6 ON	46 - 135 m (151 - 450 ft)	31 - 100 m (101 - 355 ft)
1, 3, 7 ON	136 - 225 m (451 - 750 ft)	101 - 200 m (356 - 655 ft)

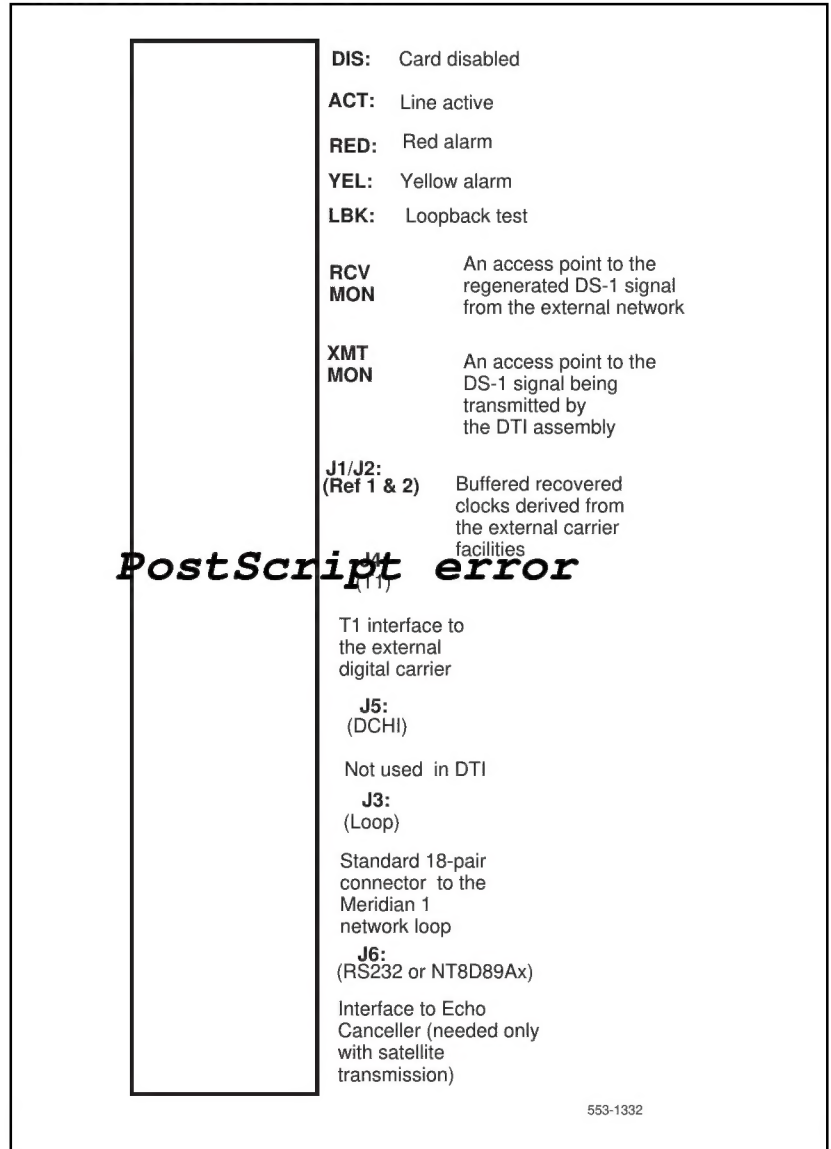
Table 4
SW3 options for the QPC720 PRI/DTI

Switch 3 options for PRI/DTI mode			
SW3-1	ON	=	extended superframe format (ESF)
	OFF	=	superframe format (SF)
SW3-2	ON	=	B8ZS line encoding (required for 64 kbs)
	OFF	=	AMI line encoding
SW3-3	ON	=	facility data link (FDL) yellow alarm method (cannot be used in Canada)
	OFF	=	Digit 2 yellow alarm method
Note 1: All switch positions for S2 (location B22) are OFF except as shown under the column labeled "Switch S2 settings." The switch positions of the 8-pole SW3 (location E37) are OFF for DTI mode. For PRI mode, set SW3 positions as configured in LD 17. Note 2: For D2, D3, or D4 framing formats (superframe formats), set all SW3 options to OFF. Note 3: ESF and B8ZS applies only to the 1.5 Mbps DTI. DTI2/PRI2 is not supported.			

Table 5
QPC720 PRI external connectors

Faceplate designation	Type
J1	9-pin female, D-connector
J2	9-pin female, D-connector
J3	36-pin connector
J4	15-pin male, D-connector
J5	15-pin male, D-connector
J6	15-pin female, D-connector
RCV MON	Miniature bantam jack
XMT MON	Miniature bantam jack

Figure 2
QPC720 PRI faceplate layout



Cable requirements

Shielded 22 AWG (0.644 mm) cable is recommended for connecting the DTI to the cross-connect point (or a CPI to CPI connection). This cable consists of two shielded twisted-pair conductors and two shields.

The transmit and receive pairs must be individually shielded and enclosed in a polyvinyl jacket. This type of cable is commonly referred to as “6-conductor” cable. T1 cable shielding should be grounded at the cross-connect point.

To install a private T1 transmission cable, consult the Northern Telecom Transmission Division. To manufacture cables of different lengths than the standard cables provided, see “[Wire list](#)” on [page 57](#). [Table 6](#) lists the types of cable used and the lengths required for internal and external DTI connections.

Table 6
DTI cables and cable lengths

Cable type	From	To	Maximum length (feet)	Maximum length (meters)
QCAD130 NT8D79xx	QPC472 QPC720	QPC471 QPC775 (CC-0)	10	3.04
QCAD130 NT8D79xx	QPC472 QPC720	QPC471 QPC775 (CC-1)	10	3.04
QCAD124 NT8D85xx	QPC472 QPC720	QPC414 Network	45	13.71
QCAD128 NT8D83xx	QPC472 QPC720	Bulkhead I/O panels	25	7.62
RS-232 NT8D89Ax	QPC472 QPC720	Echo Cancellor	50	15.25
22AWG	Echo Cancellor	DSX-1	655	199.64
NT8D97xx	I/O panel	T1 I/O	50	15.25

Installation procedures

The DTI/PRI card occupies two adjacent slots on a shelf. Locations vary as shown in [Table 7](#).

Table 7
Possible card locations by system

System	Shelf/Module	Slot
ST, STE	CE	5-12
	DTI expansion	2-8
MS	CE	5-12
	CE expansion	2-9, 11-12, 12-13
N/NT/RT	Network (LH)	5-12
	Network (RH)	2-10
	DTI expansion (RT only)	2-8
XN/XT	Network (LH)	4-10
	Network (RH)	5-11
Option 21A	CE/PE	Net: 4-8
Option 21	CE/PE	Net: 4-8 RPE: 1, 11-12
Options 51,61	CPU/Net	1-8 RPE:1, 11,12
Option 71	CPU	15-16 Net: 2, 5-9, 13-14 RPE: 1, 11-12

Table 8 shows the cable connections for the different systems. Not all cables apply to every system; read the Comments section carefully.

Table 8
Cable connections to the Clock Controller, Network, Patch panel, I/O panel, and Echo Cancellor (Part 1 of 2)

Cable type	From	CON	To	DES	CON	Comments
QCAD130 NT8D79xx	QPC720/ QPC472	J1 J1	QPC471 QPC775	CC-0	J2	Run only when DTI is primary reference clock source
QCAD130 NT8D79xx	QPC720/ QPC472	J1	QPC471	CC-0	J1	Run only when DTI is secondary reference clock source.
QCAD130 NT8D79xx	QPC720	J2	QPC471	CC-1	J2	Only when primary clock source. For RT in Single-Group mode only; not for ST, STE, or MS.
QCAD130 NT8D79xx	QPC720	J2	QPC471	CC-1	J1	Only when secondary clock source. For N/NT/RT in Single-Group mode only; not for ST, STE, or MS.
QCAD110 NT8D74xx	QPC471 QPC775	J3	QPC417	SCG0 SCG1		Applies only to XN/XT
QCAD125 NT8D75xx	QPC471	J3	QPC471	CC-1	J3	Applies only to N/NT/RT Single-Group mode.
QCAD124 NT8D85xx	QPC720/ QPC472	J3	Network			Run to connector on associated Network card. (For Half-Group mode only for the MS; for Single-Group mode only for the N/NT/RT).
QCAD124 NT8D85xx	QPC720/ QPC472	J3	Network			Run to connector on associated Network card. Applies only to N/NT/RT Half-Group mode.

Table 8
Cable connections to the Clock Controller, Network, Patch panel, I/O panel, and Echo Cancellor (Part 2 of 2)

Cable type	From	CON	To	DES	CON	Comments
QCAD133 NT8D83xx	I/O Panel		Patch panel			Run via cabinet I/O panel to cross-connect terminal or Echo Cancellor from shielded system.
QCAD133 NT8D83xx	QPC720/ QPC472	J4 J5	Patch panel			Run via cabinet I/O panel to cross-connect terminal or Echo Cancellor from non-shielded system.
QCAD129 NT9J93xx	QPC720/ QPC472	J6 J4	I/O Panel			Run via cabinet I/O panel to cross-connect terminal or Echo Cancellor from shielded system.
RS232 NT8D89xx	I/O Panel		Echo Cancellor			Run via cabinet I/O panel to cross-connect terminal or Echo Cancellor from shielded system.
RS232 NT8D89xx	QPC720/ QPC472	J6 J4	Echo Cancellor			Run to cross-connect terminal or Echo Cancellor from shielded system.

Follow the steps below to install the card:

- 1 Determine the cabinet and shelf location of the card to be installed.
- 2 Unpack and inspect cards.
- 3 Set option switches on the QPC472 as shown in [Table 1](#). For the QPC720, refer to the switch and connector information in [Table 3](#) and [Table 4](#).
- 4 Install the card into the appropriate slot as shown in [Table 7](#), “Possible card locations by system,” on page 11.
- 5 Install Network card.
- 6 If required, install I/O adapters in I/O panel.

- 7 Attach cables. Refer to “Cable requirements” on page 10 for general cable information. Table 6 lists the cables required and Table 8 describes cable connections. Illustrations of the cabling arrangement for specific systems appear in the figures in each section.

Note: The figures in each section show cabling arrangements for the QPC720 card. The equivalent connections on the DTI card are as follows:

QPC720 J4 = QPC472 J5

QPC720 J6 = QPC472 J4

- 8 If required, install connecting blocks at MDF or wall mounted cross-connect terminal.
- 9 If required, designate connecting blocks at MDF or wall mounted cross-connect terminal.
- 10 If required, install Network Channel Terminating Equipment (NCTE).
- 11 Cross-connect DTI circuits.
- 12 Run DTI acceptance/verification tests.
- 13 Add related office data into system memory. Refer to the work order and “Data administration” on page 43.

Removing the DTI card

- 1 Disable Network Loop using DTI Maintenance LD 60. The command is DISL loop.
- 2 Remove data from memory.
- 3 Determine the cabinet and shelf location of the cards to be removed.
- 4 Remove cross connections at MDF to wall-mounted cross-connect terminal.
- 5 Disconnect DTI cables at Echo Cancellor and at carrier interface (for example, Office Repeater, NCTE equipment).
- 6 Tag and disconnect cables from card. Rearrange Clock Controller card cables if required.
- 7 Remove DTI and Network cards.

Note: In a dual system, if the other circuit of the dual Network card is in use, ignore Step 7 for the Network card.

- 8 Pack and store card.
- 9 Close cabinet doors.

ST, STE systems

For basic information on installing a DTI card, refer to “[Installation procedures](#)” on page 11. See [Figure 3](#) for DTI cabling arrangement in these systems. [Figure 4](#) shows switch settings in DTI mode.

Figure 3
ST, STE cabling arrangement

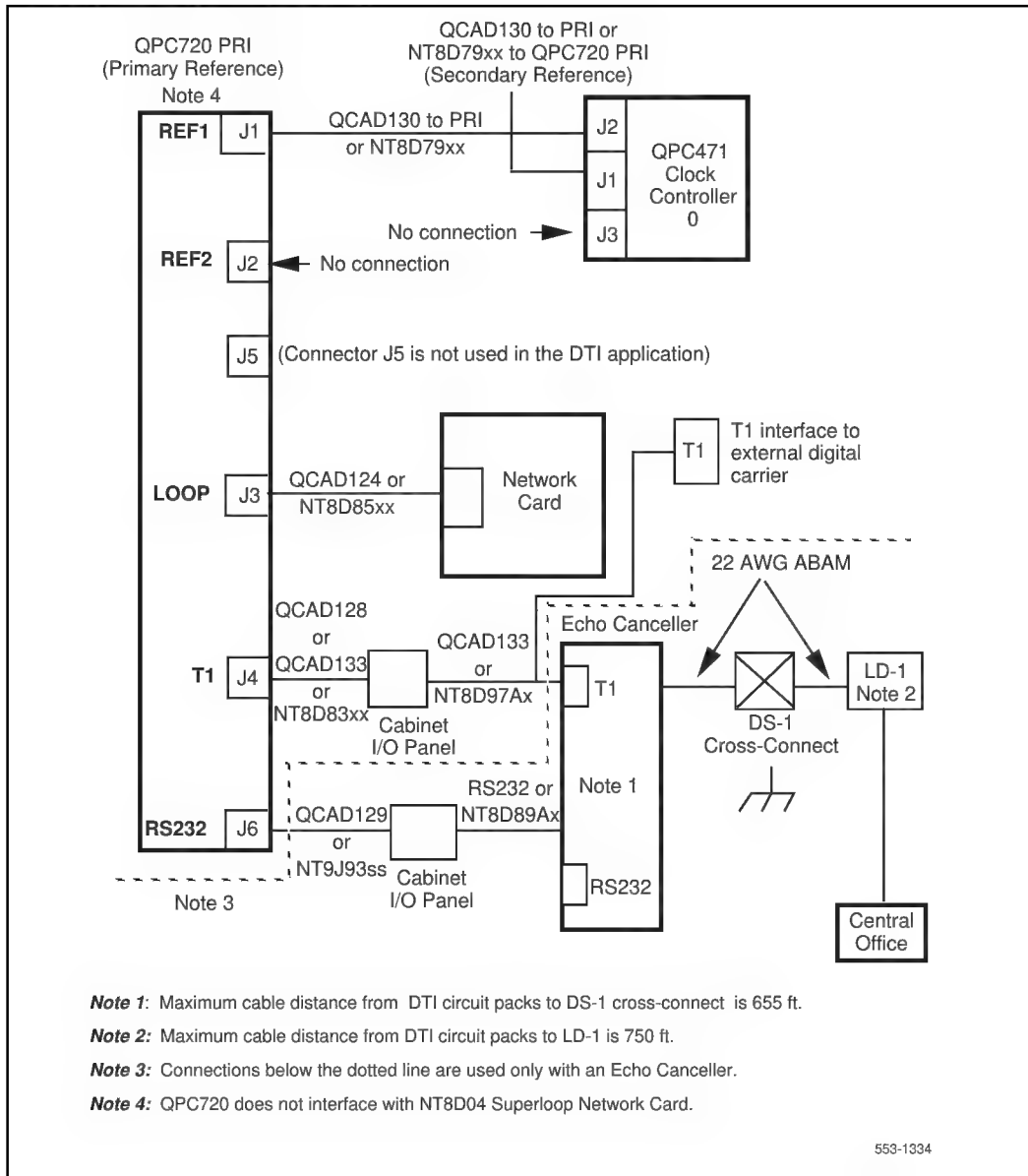
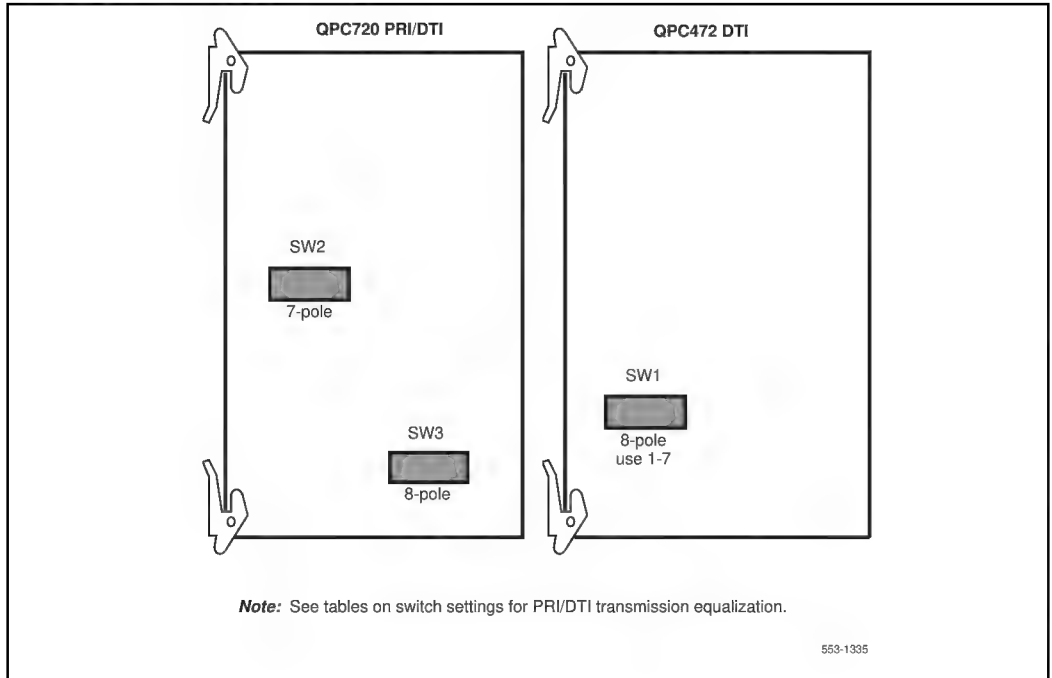


Figure 4
Switch settings in DTI mode



MS systems

For basic information on installing a DTI card, refer to “[Installation procedures](#)” on page 11. [Figure 5](#) illustrates switch settings. See [Figure 6](#) for DTI cabling arrangement in MS systems.

When no vacant positions are available to install DTI cards, additional Network shelves can replace Peripheral Equipment shelves located on the rear of the Common Equipment, Tape, or Disk shelves.

If an additional cabinet is required to install more Network shelves, use a QCA109 cabinet.

Figure 5
Switch settings in DTI mode

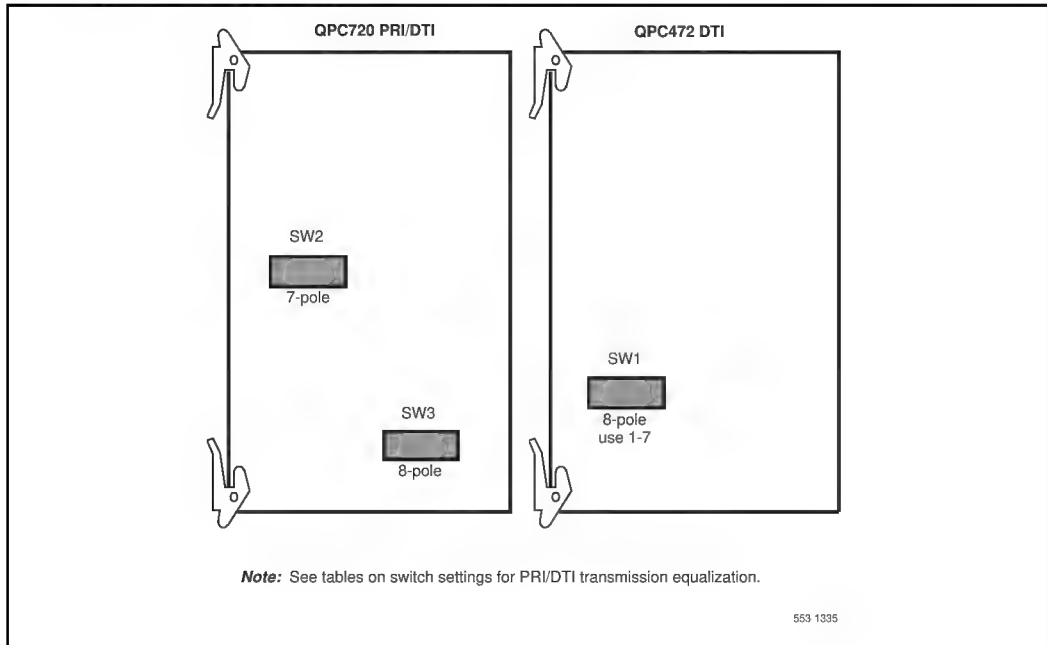
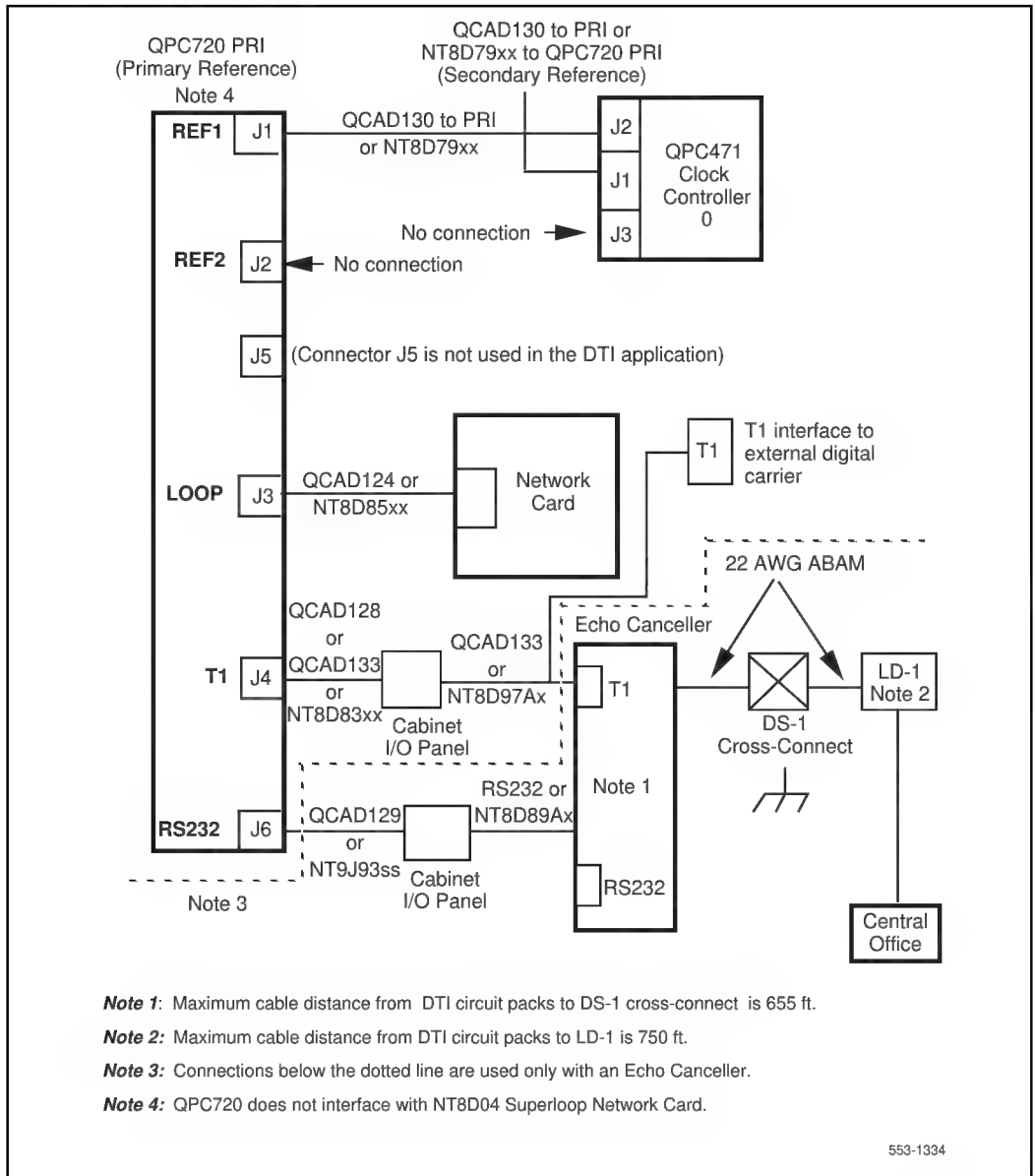


Figure 6
MS cabling arrangement



N/NT and RT systems

For basic information on installing a DTI card, refer to **“Installation procedures” on page 11**. As many as three cards can be plugged into an empty Network shelf, along with a Power Converter card.

When no vacant positions are available to install DTI cards, additional Network shelves can replace Peripheral Equipment shelves located on the rear of the Common Equipment, Tape, or Disk shelves. Refer to **“Installing an additional Network shelf on the N/NT” on page 22** for details.

If an additional cabinet is required to install more Network shelves, use a QPC58 cabinet.

Figure 7 shows switch settings in DTI mode. See **Figure 8** for DTI cabling arrangement in N/NT, RT, and 61 single and half group systems.

Figure 7
Switch settings in DTI mode

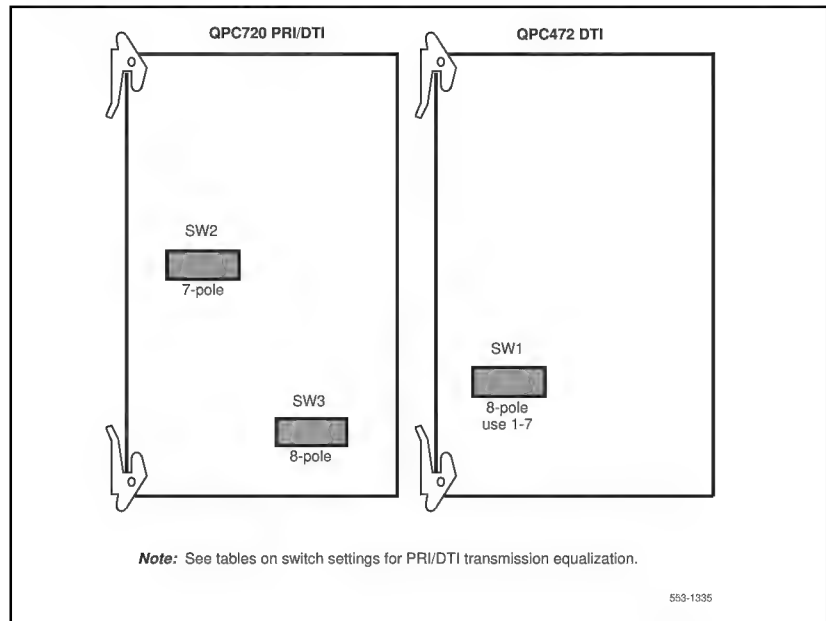
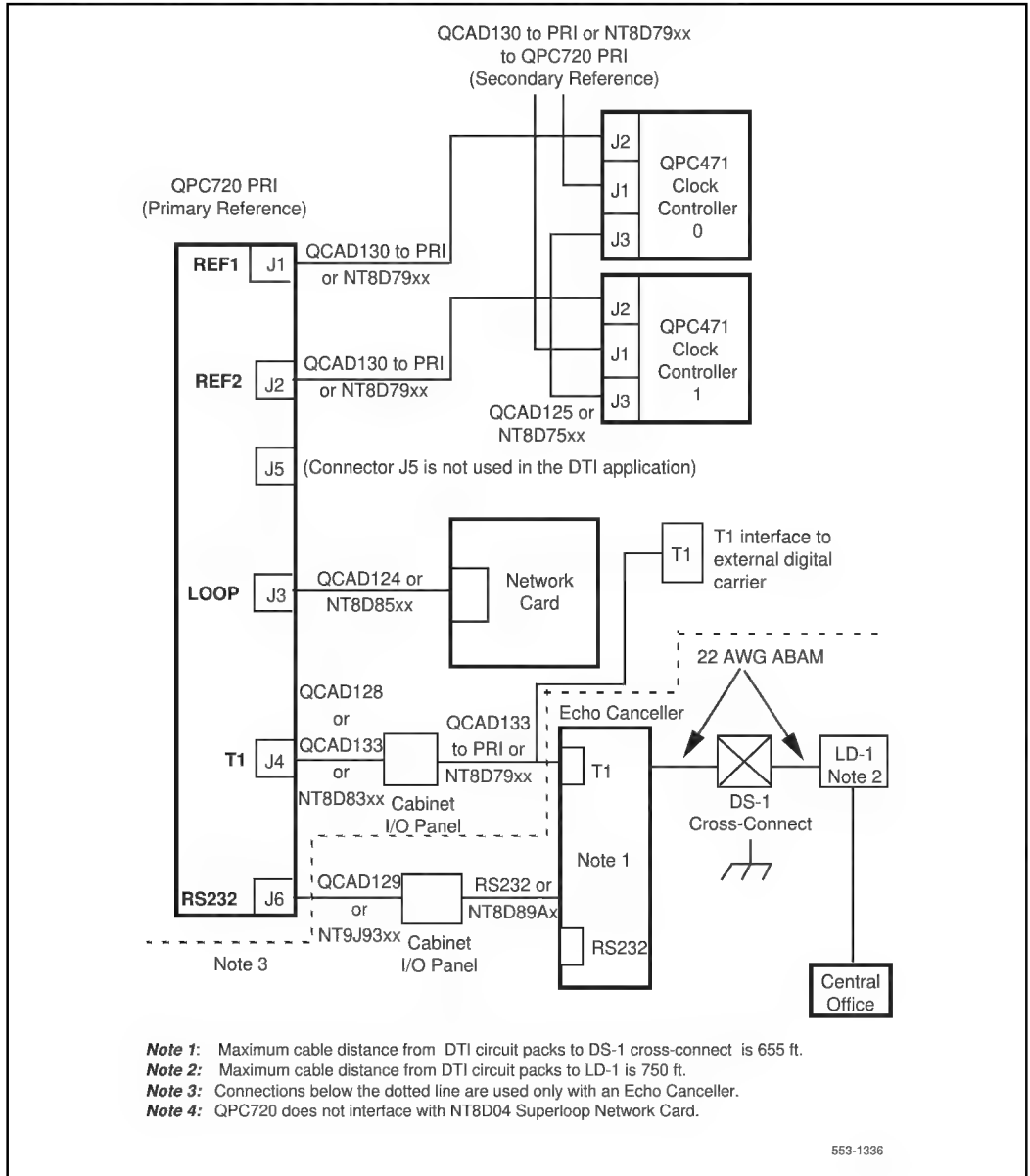


Figure 8
N/NT, 51, RT, and 61 single and half group cabling arrangement



Installing an additional Network shelf on the N/NT

CAUTION

The maximum number of DTI cards must not exceed three per shelf because the Network shelf cable harness shares the power breaker associated with each CPU.

This procedure is used when additional shelf space is required for DTI cards in N or NT, 51, and 61 systems. A QUD15 cooling unit is required for each additional shelf installed. When an additional shelf space is required, it may be necessary to install a QCA108 network expansion cabinet to provide the additional space.

- 1 Determine the cabinet and shelf location of the cards to be removed.
Note: There are only two locations possible. They should be listed behind the MSU and CPU.
- 2 Unpack and inspect the shelf.
- 3 Remove the existing left or right rear PE shelf (if required).
- 4 Install the additional Network shelf in the PE location. See Step 3
- 5 Install a QUD15 cooling unit directly below the Network shelf and secure with four mounting screws.
- 6 Install and connect the QCAD172A power cable to the added QUD15 cooling unit as follows:
- 7 If the added QUD15 is located below the *left* Network shelf, unplug the C11 connector from the QCAD111 power harness that connects to the existing left side QUD15.
- 8 Plug the C11 connector into the single-ended connector of the QCAD172A power cable.
- 9 Plug one of the two connectors at the other end of the C11 connector that was removed.
- 10 Plug the remaining connector of the QCAD172A power cable into the added QUD15.

- 11** If the added QUD15 is located below the *right* Network shelf, use the C21 connector from the QCAD111 power harness instead of the C11. Otherwise, the procedure is identical.
- 12** At the QCAD111 power wiring harness, untie and then connect the C17 connectorized power connection cable to the right rear Network shelf (connect the C19 connectorized cable to the left rear Network shelf).

CAUTION

Do not place the cards in the shelf until Step 12 is completed.

- 13** Install DTI trunks and enter related shelf and DTI office data into system memory.

XN/XT systems

For basic information on installing a DTI card, refer to **“Installation procedures” on page 11**. As many as three cards can be plugged into an empty Network shelf along with a Power Converter card.

When no vacant positions are available to install DTI cards, additional Network shelves can replace Peripheral Equipment shelves located on the rear of the Common Equipment, Tape, or Disk shelves.

If an additional cabinet is required to install more Network shelves, use a QPC108 cabinet with XN or XT and 71 systems.

Figure 9 illustrates switch settings. See **Figure 10** for a diagram of the XN/XT/71 DTI cabling arrangement.

Figure 9
Switch settings in DTI mode

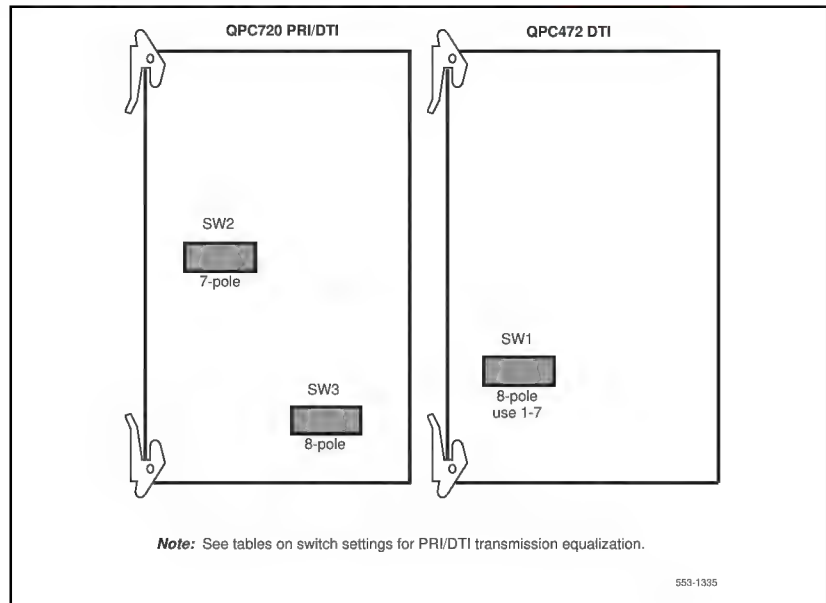
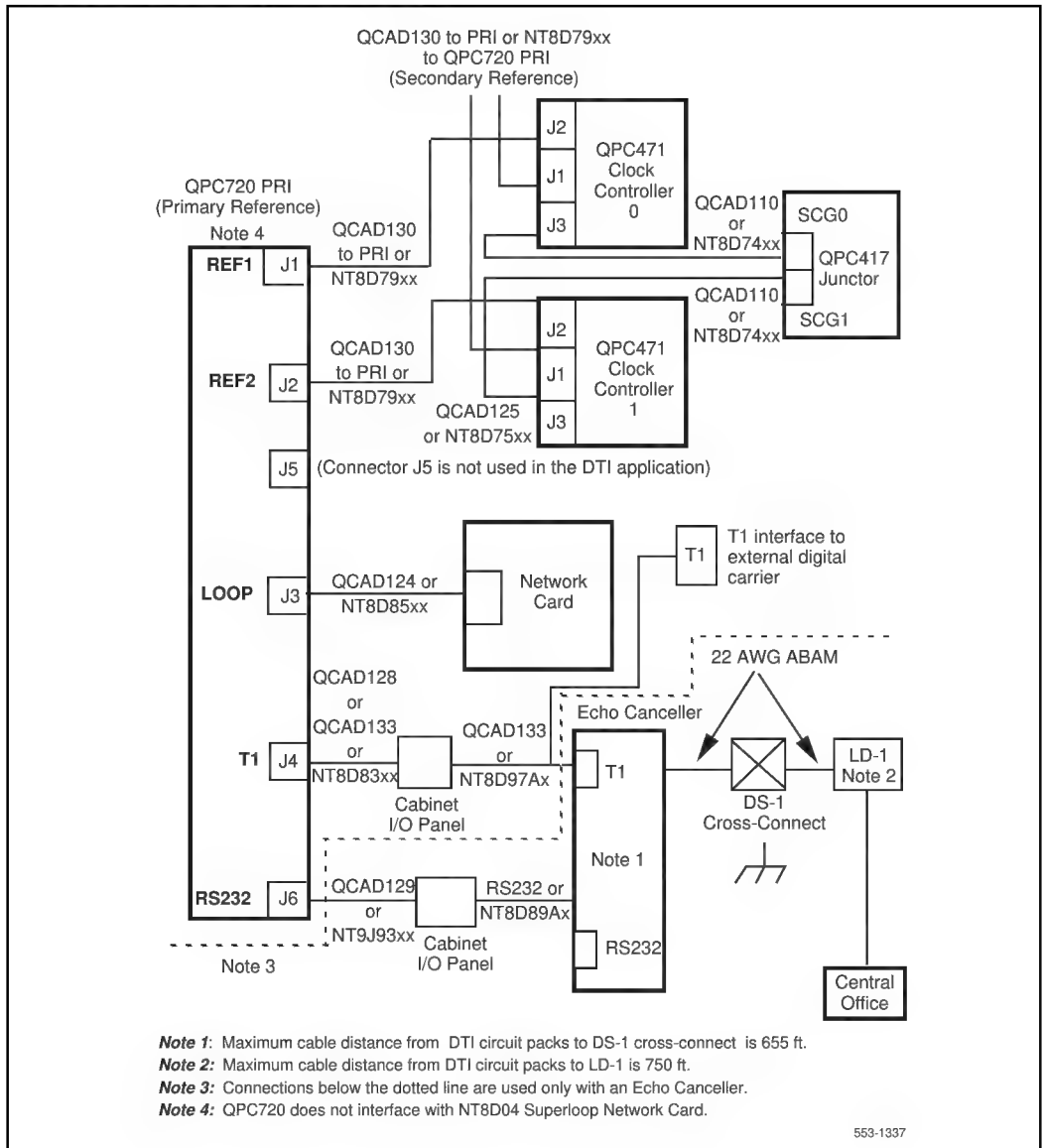


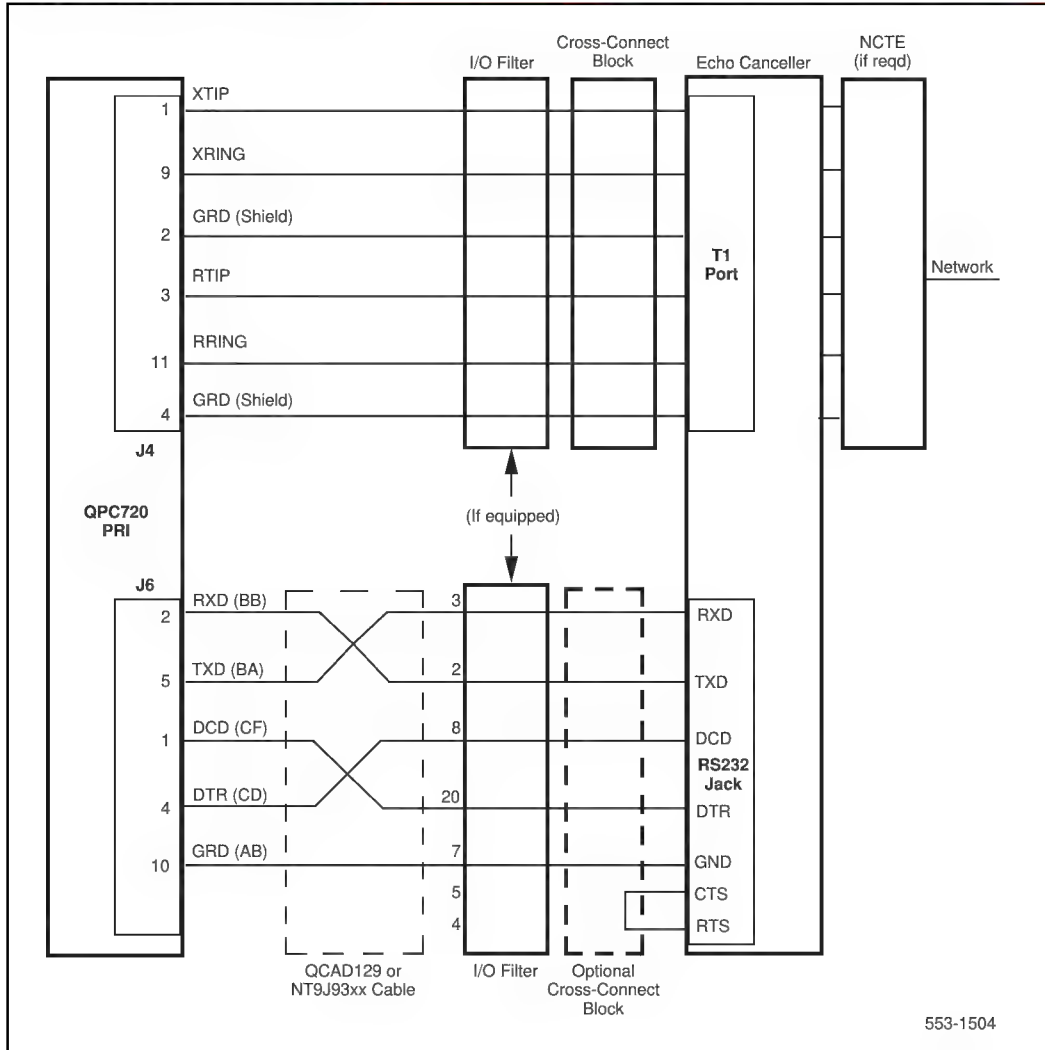
Figure 10
XN/XT and 71 cabling arrangement



21A, 21, 51, 61, 71, and 81

For basic information on installing a DTI card, refer to **“Installation procedures”** on page 11. For DTI cabling arrangements, refer to **Figure 11**.

Figure 11
DTI-to-Echo Canceller cabling



Echo Cancellor interface

An Echo Cancellor is used in conjunction with a Meridian 1 system for satellite transmission. Refer to “**Cable requirements**” on page 10 for general cabling information. The Echo Cancellor is controlled by an RS-232 port on the DTI card. **Tables 9, 10, and 11** give the Echo Cancellor pin assignments, operating parameters, and initialization procedures.

Table 9
DTI-to-Echo Cancellor pin assignments

Signal	EIA RS232-C circuit designation	DTI pin	Echo Cancellor pin
Transmitted Data (TXD)	BA	5	2
Received Data (RXD)	BB	2	3
Request to Send (RTS)	CC	-	4
Clear to Send (CTS)	CB	-	5
Signal Ground (common return)	AB	10	7
Received Line Signal Detector (DCD)	CF	1	8
Data Terminal Ready (DTR)	CD	4	20

Table 10
Operating parameters for the Echo Cancellor

Data Transfer Rate	4800 baud
System Unit Number	1
Display Timeout	active
Failures Before Alarm	3

Table 11
Settings for the 24 channels on the Echo Cancellor

Bypass	OFF
Off-Hook	ON
Cancellor Only	OFF
H Reset	OFF
H Hold	OFF

Clock Controller installation

There are three steps to installing a Clock Controller:

- 1 Determining the location of the Clock Controller card (shelf and slot).
- 2 Setting the switches on the card.
- 3 Inserting the card and connecting the cables. Refer to “**Cable requirements**” on page 10 for general cabling information. This step may also entail removing an old card.

The remaining sections of this chapter describe the details of this process.

CAUTION

Do not deviate from the procedures described in this section, as deviation stops call processing.

Determining slots and shelves

The Clock Controller card installation site varies from system to system.

Table 12 shows the systems, the shelves used, and the available slot or slots.

Table 12
Clock Controller shelves and slots

System	Shelf	Slot(s)
ST, STE	CE	5-12
MS	CE	9
RT	network	13
N, NT, 51	QSD39 network (LH)	13
	QSD40 network (RH)	2
XN	QSD17 CPU	14
XT	QSD62	15
21, 21E	NT8D11 CE	4-5
61	NT6D39 CPU/NET	9
71	NT8D34 CE Cube	14
81	core	6

Before installing a Clock Controller, set the switches as shown in **Tables 13, 14, 15, and 16** below. The first three tables display the settings for different vintages of the QPC471. **Table 16** shows the settings for the QPC775.

Table 13
Clock Controller switch settings for QPC471 vintage A

System	Switch	Setting
N, NT, RT	SW2	ON
XN, XT	SW2	OFF
Vintage A applies only to these systems		

Table 14
Clock Controller switch settings for QPC471 vintages B, C, D, E, F,
and G

System	Switch	Setting
ST, STE, 21, 21A, 21E	SW1	ON
	SW2	OFF
	Jumper Plug J1	TP8-9
	Jumper Plug J2	TP11-TP12
MS	SW1	ON
	SW2	ON
	Jumper Plug J1	TP9-TP10
	Jumper Plug J2	TP12-TP13
N, NT, RT, 51, 61	SW1	ON
	SW2	OFF
	Jumper Plug J1	TP8-TP9
	Jumper Plug J2	TP11-TP12
XN, XT, 71	SW1	OFF
	SW2	OFF
	Jumper Plug J1	TP8-TP9
	Jumper Plug J2	TP11-TP12

Table 15
Clock Controller switch settings for QPC471 vintage H

System	SW1				SW2				SW4			
ST, STE, 21A, 21, 21E	on	on	on	on	off	off	off	off	off	off	off	off
MS, SN	on	on	on	on	on	on	on	on	off	off	off	off
RT, N, NT, 51, 61	on	on	on	on	off	off	off	off	off	on	*	*
XN, XT, 71, 81	off	off	off	off	off	off	off	off	off	on	*	*
Cable length between the J3 faceplate connectors:												
0-4.3 m (0-14 ft)											off	off
4.6-6.1m (15-50 ft)											off	on
6.4-10.1m (21-33 ft)											on	off
10.4-15.2 m (34-50 ft)											on	on
• If there is only one Clock Controller card in the system, set to OFF. If there are two Clock Controller cards, set to match the cable length between the J3 faceplate connectors. Determine the total cable length (no single cable can exceed 25 ft.) between the J3 connectors. Both cards must have the same setting.												

Table 16
Clock Controller switch settings for QPC775

System	SW2	SW3	SW4
N, NT, RT, ST, STE, 21, 21A, 21E, 51, 61	ON	OFF	ON
MS, SN	ON	ON	OFF
XN, XT, 71, 81	OFF	OFF	ON

Replacing a Clock Controller

Step 2 in the following procedures (“[Installing a Clock Controller](#)”) explains how to replace a card.

Do not disable an active clock or a clock associated with an active CPU.

Installing a Clock Controller

Be sure to inspect the Clock Controller card before installing it. Refer to the tables earlier in this chapter for shelf, slot, and switch setting information. Remember not to use both the QPC471 and the QPC775 on a single system. QPC471 vintage H cards cannot be mixed with cards of an earlier vintage.

Starting the Clock Controller

The Clock Controller, when first enabled, is in free run mode. It stays in this mode for several minutes before being switched to tracking mode. Manual intervention via LD 60 can force the Clock Controller to remain in a particular mode.

For the earlier QPC471 vintages, up to 20 minutes may pass before the clock actually locks and tracks. The QPC471 vintage G and H cards begin tracking within five minutes.

Clock Controller commands

During the installation procedure, you will use some of the Clock Controller commands available in LD 60. In the list of commands below, “x” refers to the Clock Controller number 0 for the card associated with the CPU0 and 1 for the card associated with CPU1.

- DIS CC x: Disable system Clock Controller x
- DSCK loop: Disable clock for specified loop
- DSYL loop: Disable yellow alarm processing for loop
- ENCK loop: Enable clock for specified loop
- ENL CC x: Enable system Clock Controller x
- ENYL loop: Enable yellow alarm processing for loop
- EREF: Enable automatic switchover of system clocks
- SSCK x: Obtain status of system clock x
- SWCK: Switch system clock between active and standby
- TRCK aaa: Set Clock Controller track where aaa can be PCK (the primary DTI/PRI reference), SCLK (the secondary DTI/PRI reference) or FRUN (free running)

Procedure 1

Installing the Clock Controller in the ST, STE, 21, 21E, MS, N, RT, 51, and NT half group

Note: Refer to the tables in this section to be sure you are using the correct vintage.

- 1 Set the ENL/DIS toggle switch to DIS (disable) on the new circuit card.
- 2 If replacing an existing card:
 - Perform a status check on the clock with the SSCK command in LD 60. The new controller should have the same status.
 - Disable the old card using LD 60.

Note: ERR20 messages may be generated. These can usually be ignored. However, excessive clock switching should be avoided, especially when counters are near the maintenance or out-of-service thresholds. Excessive switching could generate threshold-exceeded messages or cause the PRI to be automatically disabled. Check the counters in LD 60. If necessary, reset the counters using the RCNT command.

- Set the old card's faceplate ENL/DIS switch to DIS.
- 3 Disconnect cables from the old Clock Controller card and remove it from the shelf.

CAUTION

The QCAD130 cable connecting the Clock Controller and DTI card must NOT be routed through the center of the cabinet past the power harness. Instead, it should be routed around the outside of the equipment shelves.

Note: The Clock Controller status display in this mode indicates NO UART (no universal async receiver transmitter). Do not perform a clock status check when receiving this code.

- 4 Install the new Clock Controller in the selected slot.

- 5** Connect the c3ables to the new card.
 - Connect the Primary reference to J2.
 - If applicable, connect the Secondary reference to J1.
- 6** Set the faceplate ENL/DIS switch to ENL (enable).
- 7** Set the error detection thresholds and clock synchronization control in LD 73 (optional if replacing card; required with a new installation).
- 8** Enable the Clock Controller by entering ENL CCx in LD 60.
- 9** To track on a Primary or Secondary reference clock, use LD 60. The command follows:
 - TRCK PCK (for Primary)
 - SCLK (for Secondary)
 - FRUN (for free-run)
- 10** Issue the SSCK command to check controller status.

Installing the Clock Controller in a single group

Procedure 2

Installing the Clock Controller in the NT, 61

- 1 Set faceplate ENL/DIS switch to DIS (disable) on the new circuit card.
- 2 If replacing an existing card, do the following:
 - Perform a status check on the clock with the SSCK command. The new card should have the same status.
 - Disable the old card using LD 60. Only a card in a standby mode associated with the standby CPU can be software-disabled.

Note: ERR20 messages may be generated. These can usually be ignored. However, excessive clock switching should be avoided, especially when counters are near the maintenance or out-of-service thresholds. Excessive switching could generate threshold-exceeded messages or cause the PRI to be automatically disabled. Check the counters in LD 60. If necessary, reset the counters using the RCNT command.

- Set the old card's faceplate ENL/DIS switch to DIS.
- Disconnect the cables from the old Clock Controller card and remove it from the shelf.

Note: The Clock Controller status display in this mode indicates NO UART (no universal async receiver transmitter). Do not perform a clock status check when receiving this code.

- 3 If the 3PE switches have not been modified to recognize the Clock Controller card, adjust them as follows:
 - QSD39 (left-hand side) SW1 OFF (Option 61 shelf 0)
 - SW2 ON
 - SW4 OFF
 - QSD40 (right-hand side) SW1 OFF (Option 61 shelf 1)
 - SW2 ON
 - SW4 OFF
 - SW8 OFF
- 4 Set faceplate ENL/DIS switch to DIS (disable).
- 5 Install Clock Controller in the selected slot.

- 6** Run and connect cables.
 - Connect the Primary reference to J2.
 - If available, connect the Secondary reference to J1.
 - Connect the cable between the two clocks to J3 on each controller card.
- 7** Set the faceplate ENL/DIS switch to ENL (enable).
- 8** Enable the Clock Controller by entering ENL CC x in LD 60.
- 9** Set the error detection thresholds and clock synchronization controls in LD 73 (optional if replacing card; required with new installation).
- 10** To track on a Primary or Secondary reference clock, use LD 60. The command follows:
 - TRCK PCK (for Primary)
 - SCLK (for Secondary)
 - FRUN (for free-run)
- 11** Issue the status check command, SSCK.
- 12** Optionally activate the new Clock Controller with the LD 60 SWCK command.
- 13** Repeat, if necessary, for the second Clock Controller.

Procedure 3

Installing the Clock Controller in the XN, XT, 71, and 81

Note: The option 81 system requires a vintage H Clock Controller.

- 1 Set faceplate ENL/DIS switch to DIS on new circuit card.
- 2 If replacing an existing card, do the following:
 - Perform a status check on the clock with the SSCK command. The new card should have the same status.
 - Disable it using LD 60. (Only a card in standby state associated with the standby CPU may be disabled using software.)

Note: ERR20 messages may be generated. These can usually be ignored. However, excessive clock switching should be avoided, especially when counters are near the maintenance or out-of-service thresholds. Excessive switching could generate threshold-exceeded messages or cause the PRI to be automatically disabled. Check the counters in LD 60. If necessary, reset the counters using the RCNT command.

- Set the old card's faceplate ENL/DIS switch to DIS (disable).
- Disconnect the cables from the old Clock Controller card and remove it from the shelf.

Note: The Clock Controller status display in this mode indicates NO UART (no universal async receiver transmitter). Do not perform a clock status check when receiving this code.

- 3 Set the faceplate ENL/DIS switch to DIS (disable).
- 4 Install the Clock Controller in the selected slot.
- 5 Run and connect the cables.
 - Connect the Primary reference to J2.
 - If available, connect the Secondary reference to J1.
 - Connect the cable between the two clocks to J3 on each controller card.
- 6 Set the faceplate ENL/DIS switch to ENL (enable).

- 7** Enable the Clock Controller by entering ENL CC x in LD 60.
- 8** Set the error detection thresholds and clock synchronization controls in LD 73 (optional with card replacement; required with new installation).
- 9** To track on a Primary or Secondary reference clock, use LD 60. The command follows:

TRCK **PCK** (for Primary)
SCLK (for Secondary)
FRUN (for free-run)
- 10** Issue the status check command, SSCK.
- 11** (Optional) Activate the newly installed Clock Controller with the LD 60 SWCK command.
- 12** Repeat, if necessary, for the second Clock Controller.

Cabling requirements

Clock Controllers can require three different kinds of cable connections.

- In a single controller system, cable QCAD130/NT8D79xx connects QPC720/QPC472 (PRI or DTI card) to QPC471/QPC775 at J2 when DTI/PRI is the Primary reference clock source.
- In a single controller system, cable QCAD130/NT8D79xx connects QPC720/QPC472 to QPC471/QPC775 at J1 when DTI/PRI is the Secondary reference clock source.
- With dual controllers, cable QCAD125/NT8D75xx connects the Clock Controller cards to each other at J3 in single-group mode.

NT8D74 Clock Controller to InterGroup cable

This cable connects the QPC471/QPC775 Clock Controller card to the NT8D36 InterGroup Module. It is available in the following lengths:

- NT8D74AC 1.2 m (4 ft)
- NT8D74AD 1.8 m (6 ft)
- NT8D74AE 2.4 m (8 ft)
- NT8D74AF 3 m (10 ft)
 (QCAD110B)
- NT8D74AJ 4.8 m (16 ft)

NT8D75 Clock Controller to Clock Controller cable

This cable connects QPC471 Clock Controller cards to each other. It is available in the following lengths:

- NT8D75AC 1.2 m (4 ft)
- NT8D75AD 1.8 m (6 ft)
- QCAD125 3 m (10 ft)

NT8D79 PRI/DTI to Clock Controller cable

This cable connects the PRI/DTI card to the QPC471 Clock Controller card.
It is available in the following lengths:

- NT8D79AB 0.6 m (2 ft)
- NT8D79AC 1.2 m (4 ft)
- NT8D79AD 1.8 m (6 ft)
- NT8D79AE 2.4 m (8 ft)
- NT8D79AF 3 m (10 ft)
 (QCAD130)